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Ratchet current in nontwist Hamiltonian systems

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ABSTRACT

Non-monotonic area-preserving maps violate the twist condition locally in phase space, giving rise to shearless invariant barriers surrounded by twin island chains in these regions of phase space. For the extended standard nontwist map, with two resonant perturbations with distinct wave numbers, we investigate the presence of such barriers and their associated island chains and compare our results with those that have been reported for the standard nontwist map with only one perturbation. Furthermore, we determine in the control parameter space the existence of the shearless barrier and the influence of the additional wave number on this condition. We show that only for odd second wave numbers are the twin island chains symmetrical. Moreover, for even wave numbers, the lack of symmetry between the chains of twin islands generates a ratchet effect that implies a directed transport in the phase space.

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